

Getting Started with the Internet of Things

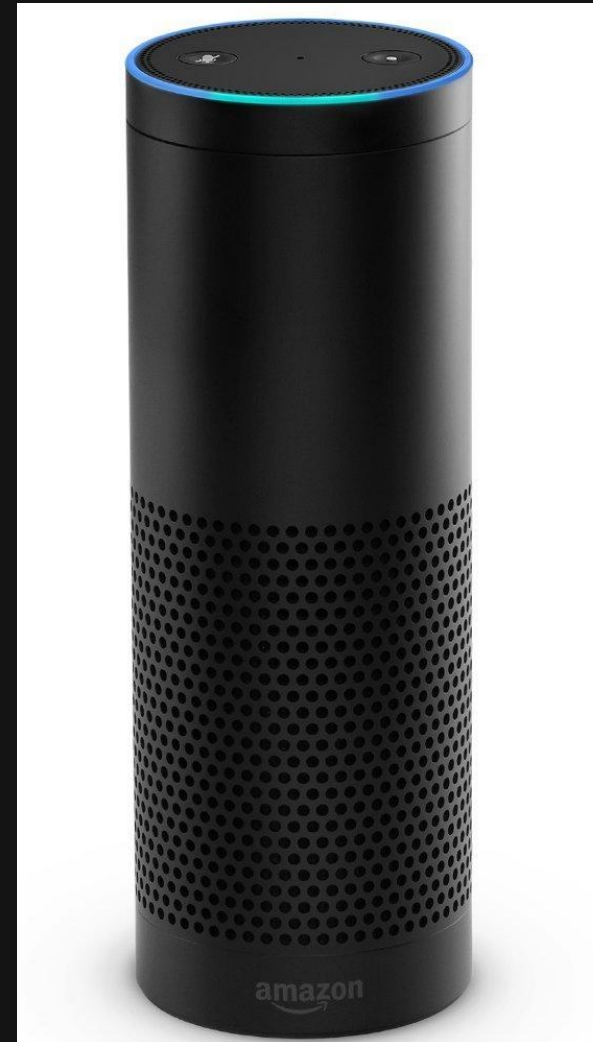


#WorkshopGoals

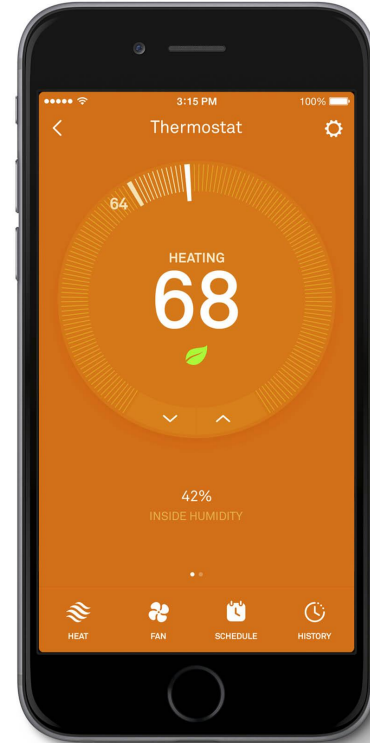
1. Show the opportunities of the Internet of Things
2. Build your first web-connected “Thing”
3. Offer resources for building more creative and complex projects

What is the Internet of Things?

- “everyday objects connected to the web”
- ubiquitous computing
- connected sensors
- “smart” objects
- the “new hardware movement” (O'Reilly)



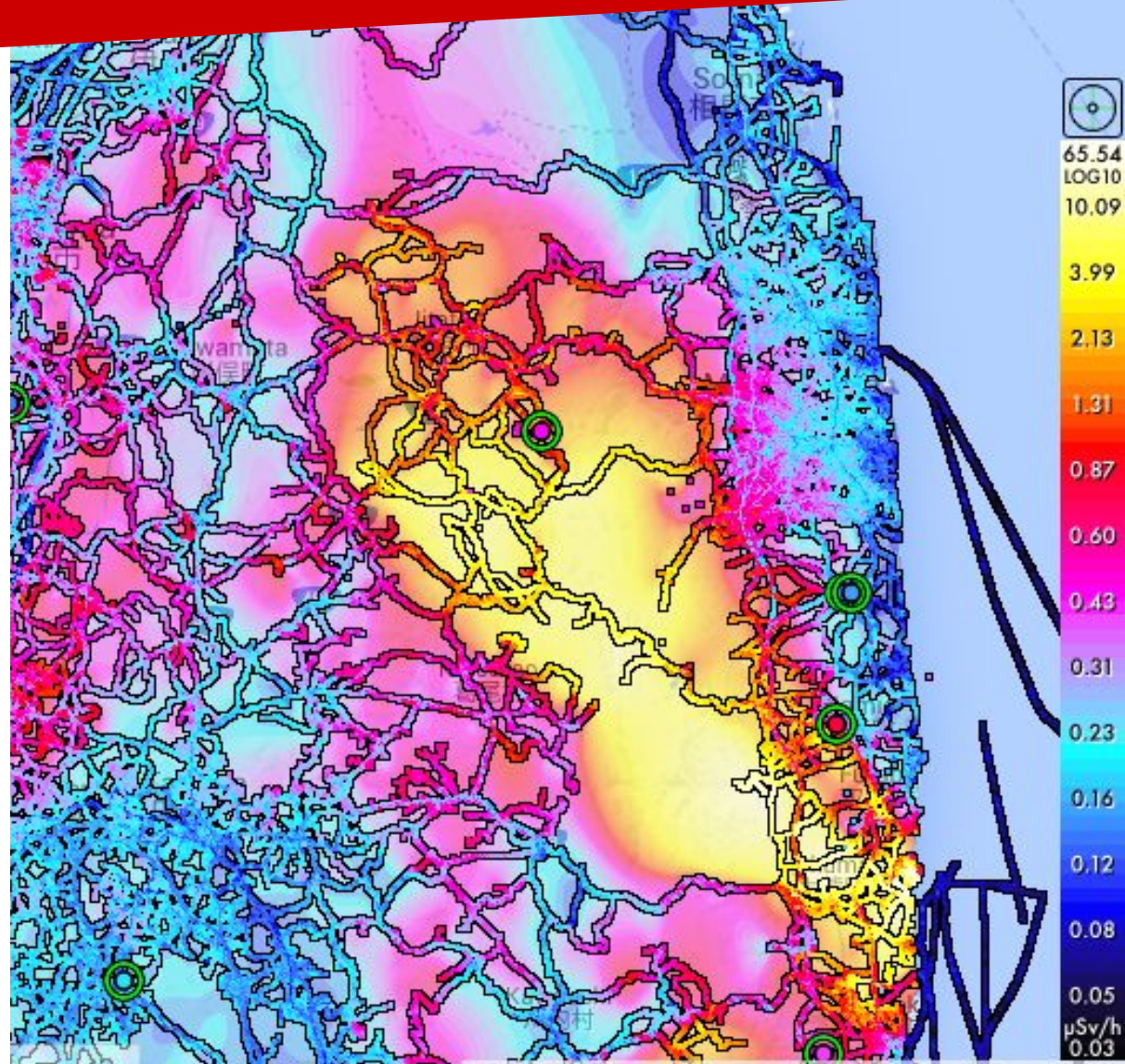
Thing #1: Nest



Thing #1: Nest



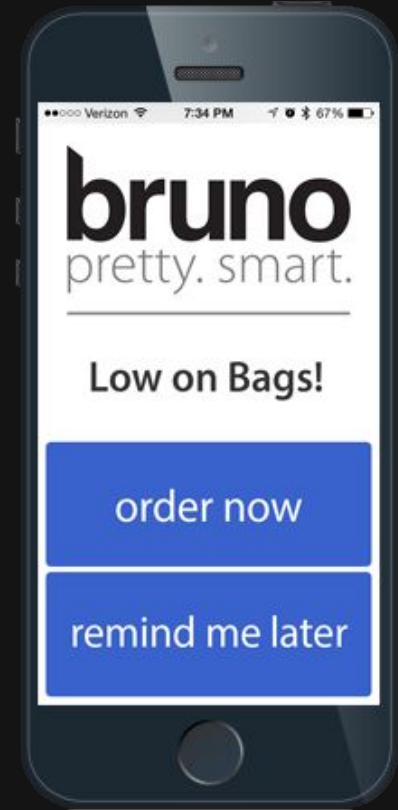
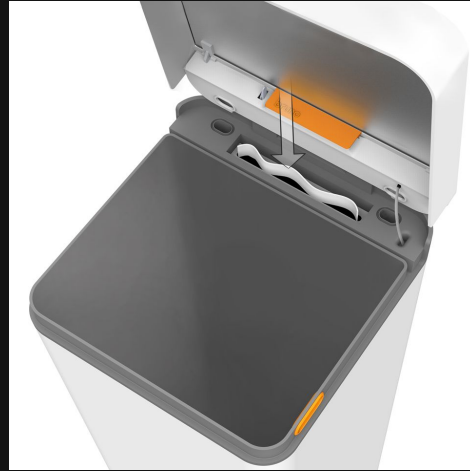
Thing #2: Safecast



Thing #2: Safecast



Hype & Nonsense



Gartner: 21 Billion IoT Devices To Invade By 2020

Gartner indicates the market for Internet of Things devices is poised to explode and will reach nearly 21 billion connected devices by 2020.

Basic Components

- **Hardware:** microcontroller or embedded computer (usually Linux)
- **Sensors:** e.g., radiation, temperature, motion, buttons
- **Actuators:** lights, motors, relays, etc.
- **Connection:** WiFi, Bluetooth, cellular
- **Data/Web Platform:** API, website, mobile app, dashboard, etc.

Options for Makers

The library offers these options:



Sparkfun Arduino Inventor Kit w/ Wifi Shield

- Arduino Compatible
- Easiest to get started



Raspberry Pi

- Full Linux with HDMI output
- Connect via Wifi or internet



Intel Galileo

- Arduino compatibility on top of embedded Linux.
- Wifi + ethernet
- More advanced and more powerful.



LightBlue Bean

- Bluetooth-connected Arduino
- Tiny and low power
- Great for wearables and mobile applications

at the **Ask Us** desk at **Hill and Hunt**

Let's Do This

<http://go.ncsu.edu/piot>

Set up the Pi

Best to do these in order:

1. Take Pi out of the case
2. Connect HDMI to Screen and Pi
3. Connect Keyboard and Mouse to Pi
4. Connect power to Screen and Pi
5. Connect red power supply to outlet

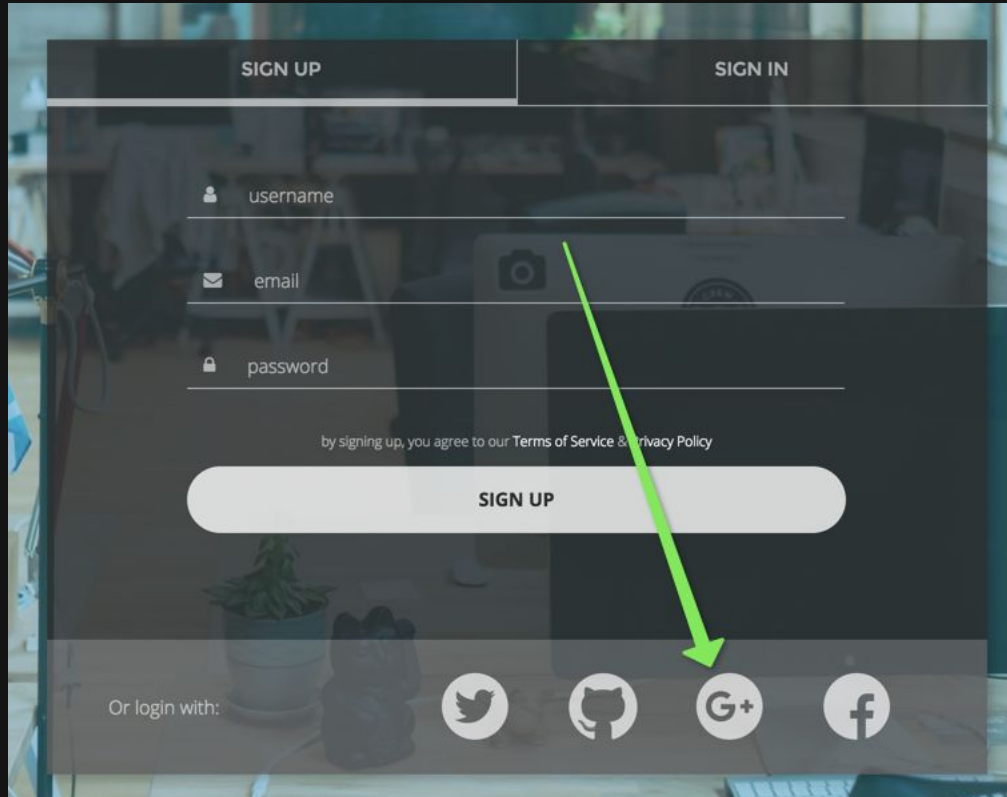
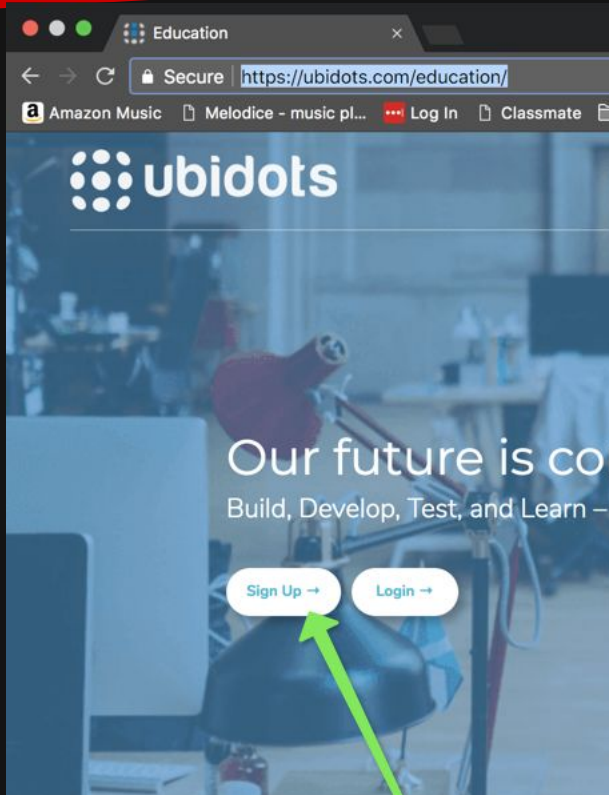
Set up the Cloud

Ubidots

ubidots.com/education/

- Free for education
- Built in graphing
- Easier than setting up our own server

Set up the Cloud



Let's Send Some Data:

Download randomdata.py
<http://go.ncsu.edu/piot>

Open it
(default should be Thonny)

Get Your API Keys

The image consists of two screenshots of the Ubidots web interface, demonstrating how to locate API keys and tokens.

Top Screenshot: The browser shows the Ubidots 'Devices' page for a specific device. A green arrow points to the 'API Credentials' option in the user profile dropdown menu (crnickel).

Bottom Screenshot: This screenshot shows the 'API Key' and 'Tokens' sections. The 'API Key' is displayed as `A1E-45c6dee7f87456aa2b307fb61424f99bd667`. The 'Tokens' section, highlighted with a green box, shows a 'Default token' as `A1E-AWzQGRAnMa3pQ5MfAIzDoE5i186Gv0` and a 'More' link.

Modify the Code

1. Add your Token
2. Change Device Label

```
DEVICE_LABEL = "Pi0T" # Put your device label here
```

3. Change Variable Labels

```
VARIABLE_LABEL_1 = "temperature" # Put your first variable label here  
VARIABLE_LABEL_2 = "humidity" # Put your second variable label here  
VARIABLE_LABEL_3 = "pressure" # Put your second variable label here
```

4. Run!

Check It on Ubidots

1. Go to your Devices
2. Open piot Device (it should create it for you.)
3. Look to see if it's reporting values

Build a Dashboard

The screenshot shows the Ubidots web application interface. At the top, there's a navigation bar with the Ubidots logo, 'FOR EDUCATION', and tabs for 'Dashboards', 'Devices', and 'Events'. A user profile 'crnickel' is logged in with 4,860 credits. Below this is a 'Dashboard' header. The main content area has a light gray background with a white box containing the text 'Add widgets to see your data in real-time'. Below this text is a smaller line: 'Click on the + icon to add a Widget. If you haven't sent any data to Ubidots, check out our API Docs to get started.' Two green arrows point from the text to the '+' icon in the top right corner and the '+' icon in the text itself. The word 'OR' is centered between the two arrows.

Education Ubidots | Dashboards

Secure | <https://app.ubidots.com/ubi/insights/#/list>

Amazon Music Melodice - music pl... Log In Classmate Headcounters LibraryH3lp WebCh... Other Bookmarks

ubidots FOR EDUCATION Dashboards Devices Events Credits: 4,860 crnickel

Dashboard

Add widgets to see your data in real-time

Click on the + icon to add a Widget. If you haven't sent any data to Ubidots, check out our API Docs to get started.

OR

Build a Dashboard

How would you like to see your data?



Chart



Metric

Choose between Line chart or Scatter plot

Select a type of widget:



Line chart



Double axis

Add a line chart showing data points of one or multiple variables


+ Add Variable

Build a Dashboard


Add a Variable to visualize in your Widget


Widget creation


Select a Device


plot

Select a Variable


humidity

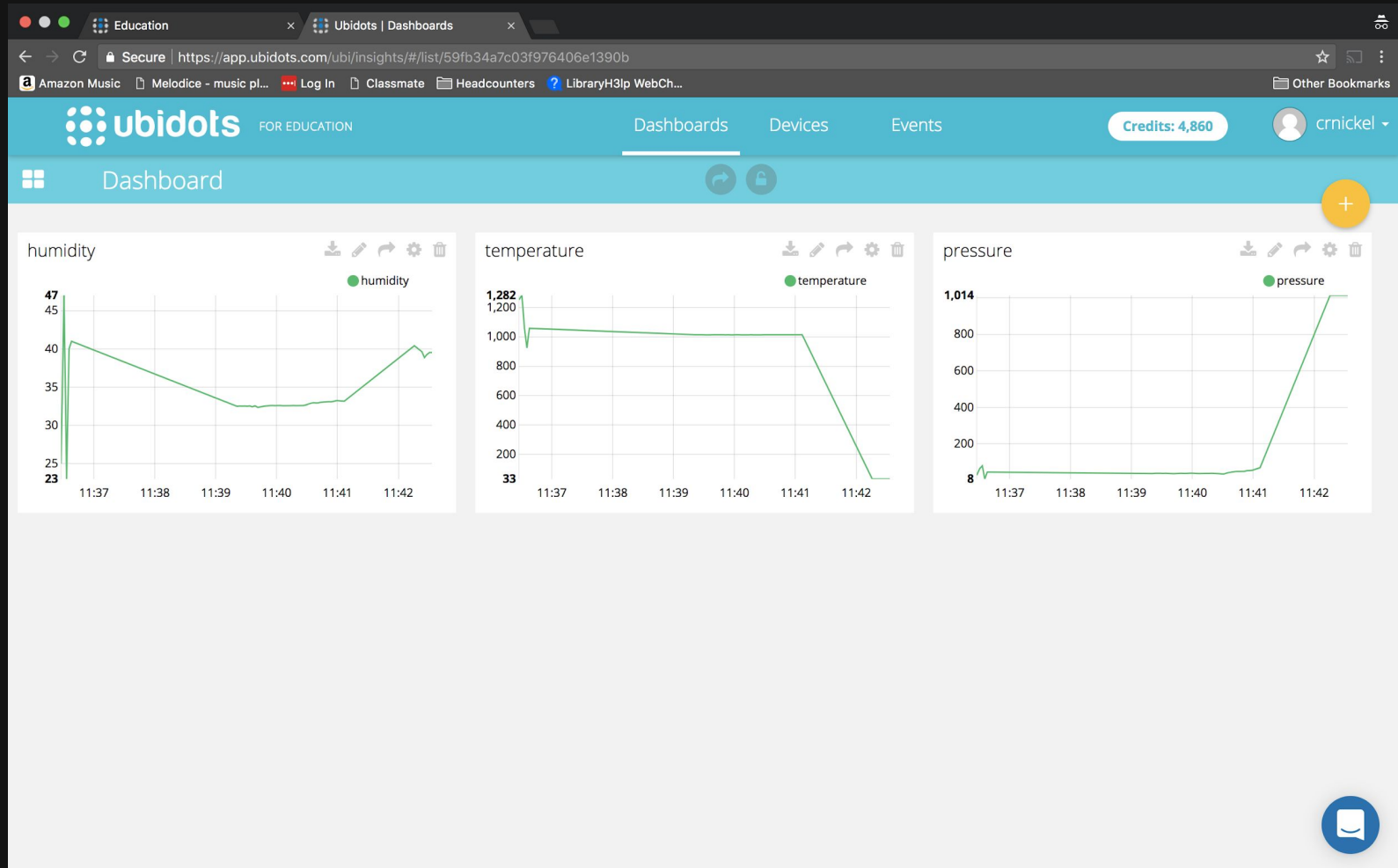

temperature


pressure

Add Variable

**Do this
three times:
one for each
variable**

Build a Dashboard



IOT!
(but fake data)

**Let's Do This
(for real)**

<http://go.ncsu.edu/piot>

Install Sensehat

- 1. Power off Pi**
- 2. Install Sensehat**
- 3. Turn Pi back on**

Let's Get Real Data:

Download sensetest.py
<http://go.ncsu.edu/piot>

Open it
(default should be Thonny)
Run!

Let's Get More Data:

Download sensethree.py
<http://go.ncsu.edu/piot>

Open it
(default should be Thonny)
Run!

Let's Combine!

Download combined.py
<http://go.ncsu.edu/piot>

Open it
(default should be Thonny)

Modify the Code

1. Add your Token
2. Change Device Label

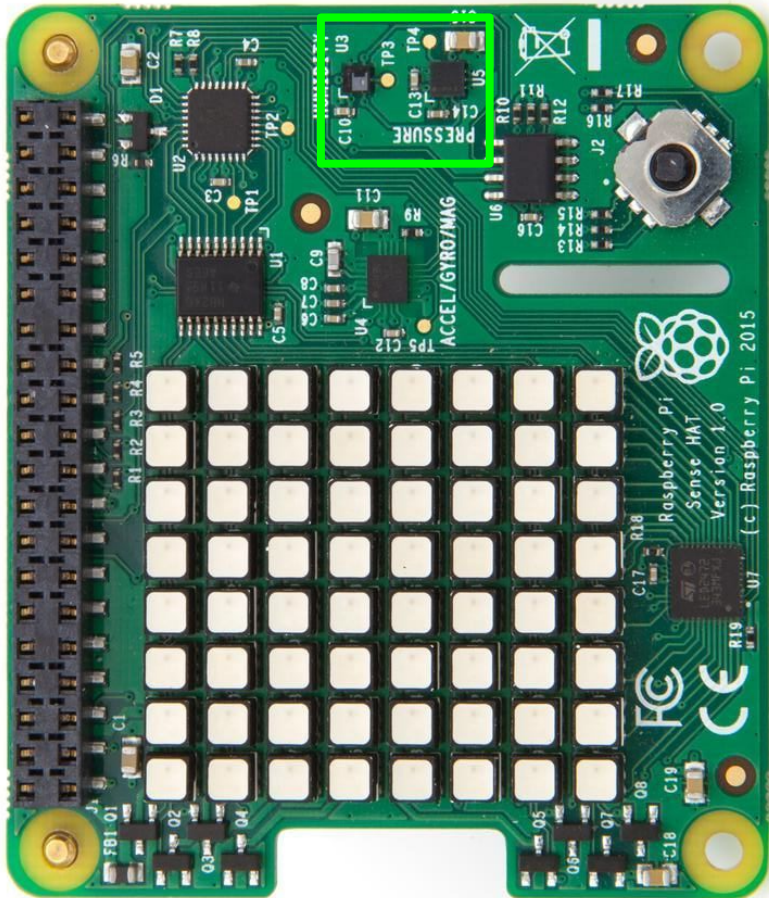
```
DEVICE_LABEL = "Pi0T" # Put your device label here
```

3. Change Variable Labels

```
VARIABLE_LABEL_1 = "temperature" # Put your first variable label here  
VARIABLE_LABEL_2 = "humidity" # Put your second variable label here  
VARIABLE_LABEL_3 = "pressure" # Put your second variable label here
```

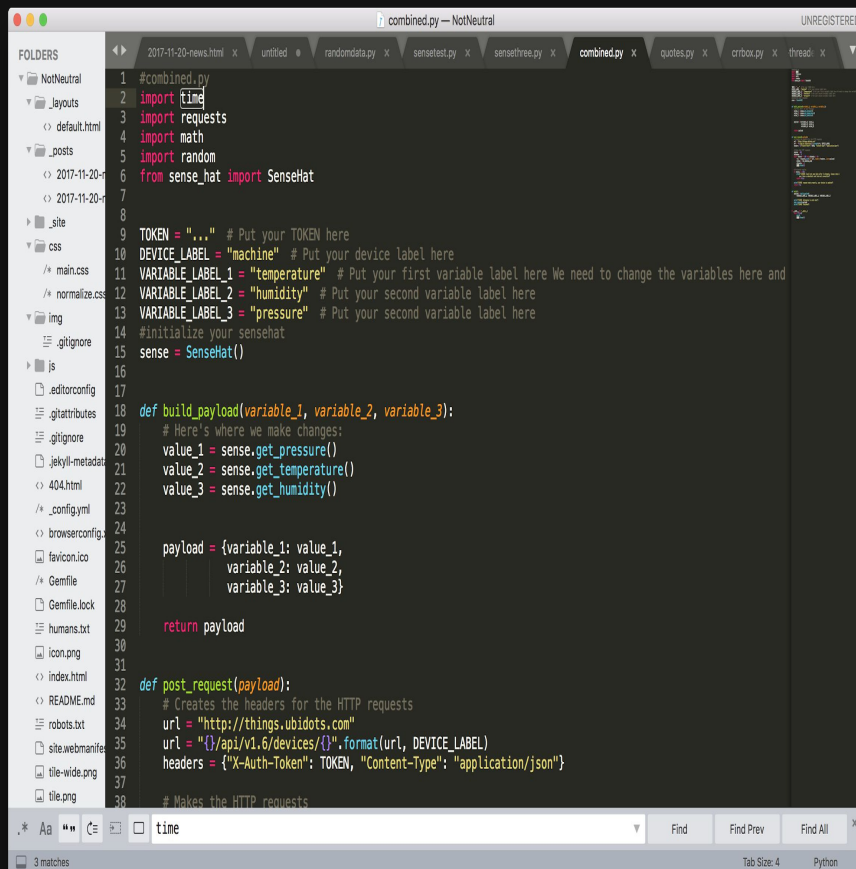
4. Run!

Play with Sensors



1. Breath on them
2. Press your finger on them

Play with the Code



The screenshot shows a code editor window titled 'combined.py - NotNeutral'. The editor contains a Python script that uses the 'sense-hat' library to interact with a Raspberry Pi Sense Hat. The script includes imports for 'time', 'requests', 'math', and 'random', along with 'SenseHat' from 'sense_hat'. It defines a 'TOKEN' and 'DEVICE_LABEL' for authentication. A 'build_payload' function is defined to create a JSON payload with sensor readings. A 'post_request' function is defined to send the payload to a specific URL. The script also includes comments for setting up the Sense Hat and making HTTP requests.

```
1 #combined.py
2 import time
3 import requests
4 import math
5 import random
6 from sense_hat import SenseHat
7
8
9 TOKEN = "..." # Put your TOKEN here
10 DEVICE_LABEL = "machine" # Put your device label here
11 VARIABLE_LABEL_1 = "temperature" # Put your first variable label here We need to change the variables here and
12 VARIABLE_LABEL_2 = "humidity" # Put your second variable label here
13 VARIABLE_LABEL_3 = "pressure" # Put your second variable label here
14 #initialize your sensehat
15 sense = SenseHat()
16
17
18 def build_payload(variable_1, variable_2, variable_3):
19     # Here's where we make changes:
20     value_1 = sense.get_pressure()
21     value_2 = sense.get_temperature()
22     value_3 = sense.get_humidity()
23
24     payload = {variable_1: value_1,
25               variable_2: value_2,
26               variable_3: value_3}
27
28     return payload
29
30
31
32 def post_request(payload):
33     # Creates the headers for the HTTP requests
34     url = "http://things.ubidots.com"
35     url = "{}api/v1.6/devices/{}".format(url, DEVICE_LABEL)
36     headers = {"X-Auth-Token": TOKEN, "Content-Type": "application/json"}
37
38     # Makes the HTTP requests
```

1. What other things can you sense?

pythonhosted.org/sense-hat

2. Change frequency of reading?

Thanks!

More info: go.ncsu.edu/iot

Colin: crnickel@ncsu.edu